US006343957B1

(12) **United States Patent**
Kuo et al.

(10) **Patent No.: US 6,343,957 B1**
(45) **Date of Patent: Feb. 5, 2002**

(54) **ELECTRICAL ADAPTER**

(75) Inventors: **Yu-Jen Kuo**; **Chin-Pao Kuo**, both of Tu-Chen (TW)

(73) Assignee: **Hon Hai Precision Ind. Co., Ltd.**, Taipei Hsien (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/852,407**

(22) Filed: **May 9, 2001**

(30) **Foreign Application Priority Data**

Sep. 29, 2000 (TW) 89216958

(51) **Int. Cl.**[7] **H01R 25/00**
(52) **U.S. Cl.** **439/638**; 439/362; 439/76.1; 439/654
(58) **Field of Search** 439/638, 76.1, 439/359, 362, 607, 654

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,236,779	A	*	12/1980	Tang	439/638
4,398,780	A	*	8/1983	Novotny et al.	439/362
5,859,766	A	*	1/1999	Van Scyoc et al.	439/362
6,176,743	B1	*	1/2001	Kuo	439/638

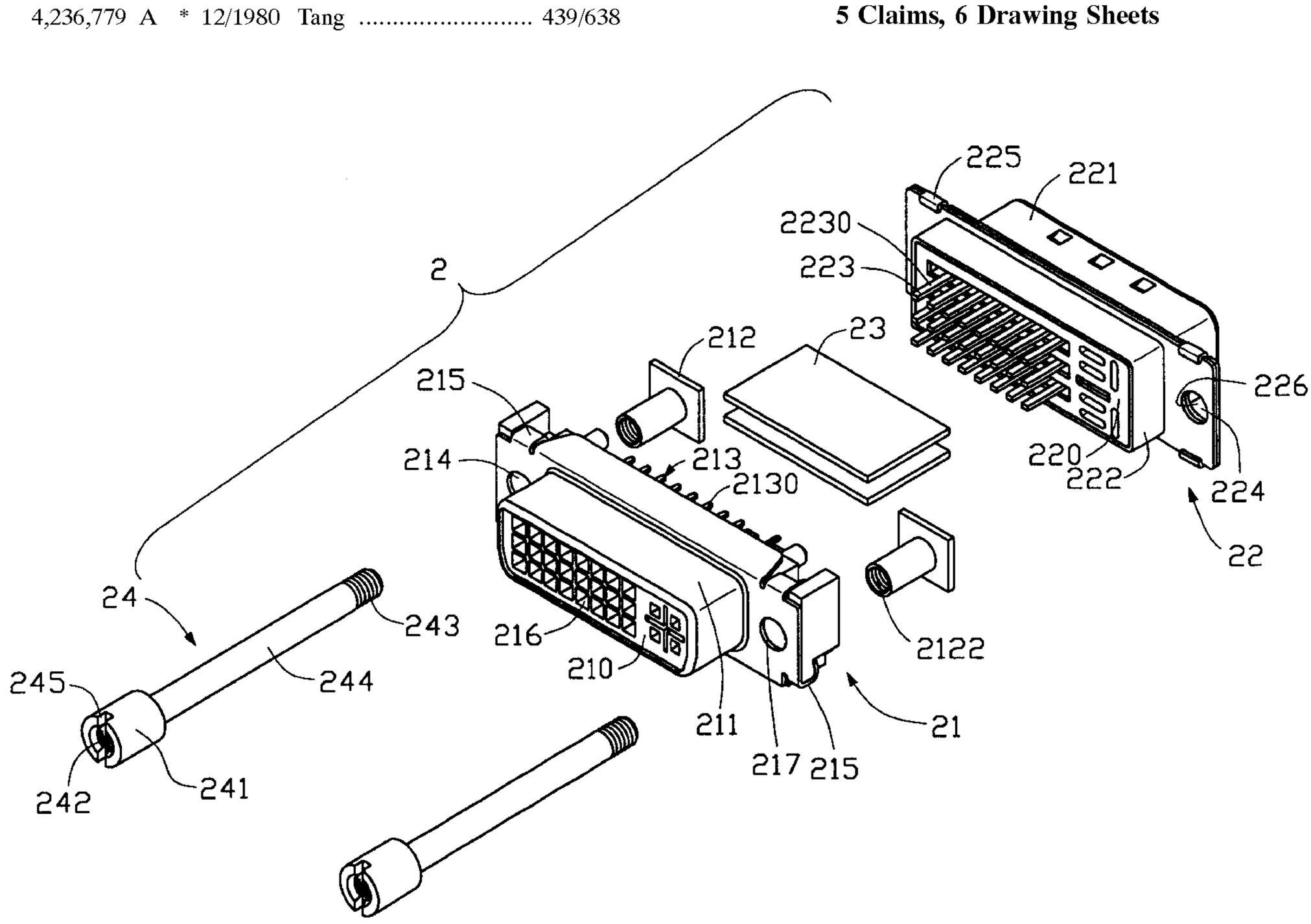
* cited by examiner

Primary Examiner—Tho D. Ta
(74) *Attorney, Agent, or Firm*—Wei Te Chung

(57) **ABSTRACT**

A DVI electrical adapter (**2**) for electrically connecting a monitor to a host computer having different interfaces includes a combined digital & analog receptacle connector (**21**), a digital-only plug connector (**22**), two printed circuit boards (PCBs) (**23**) joined between the plug connector and the receptacle connector, an insulative housing (**20**) insert molded over a center of the DVI adapter and a pair of elongated fasteners (**24**). The elongated fasteners project through two sides of the insulative housing and include a first fixing end (**241**) and a second fixing end (**243**). The second fixing end engages with nuts of a complementary receptacle connector mounted on the host computer. The first fixing end has a threaded recess accepting screws from a cable plug connector attached to the monitor. The DVI electrical adapter has a smaller size and simpler structure, and is simpler to use than prior art DVI connector.

5 Claims, 6 Drawing Sheets



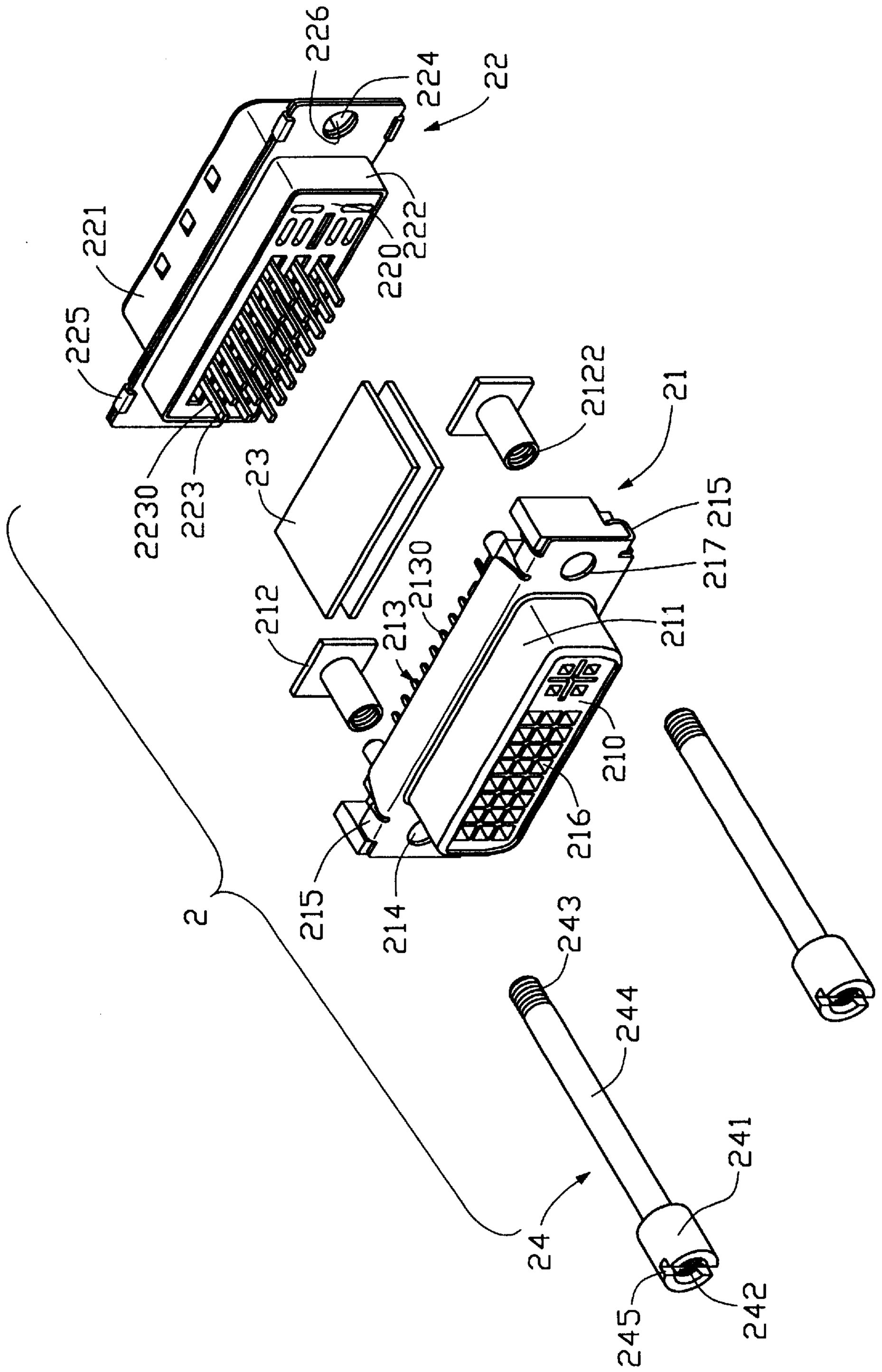

226
224
22
221
222
220
225
2230
223
23
2122
21
212
213
2130
217
215
211
210
216
215
214
2
243
244
241
24
245
242

FIG. 1

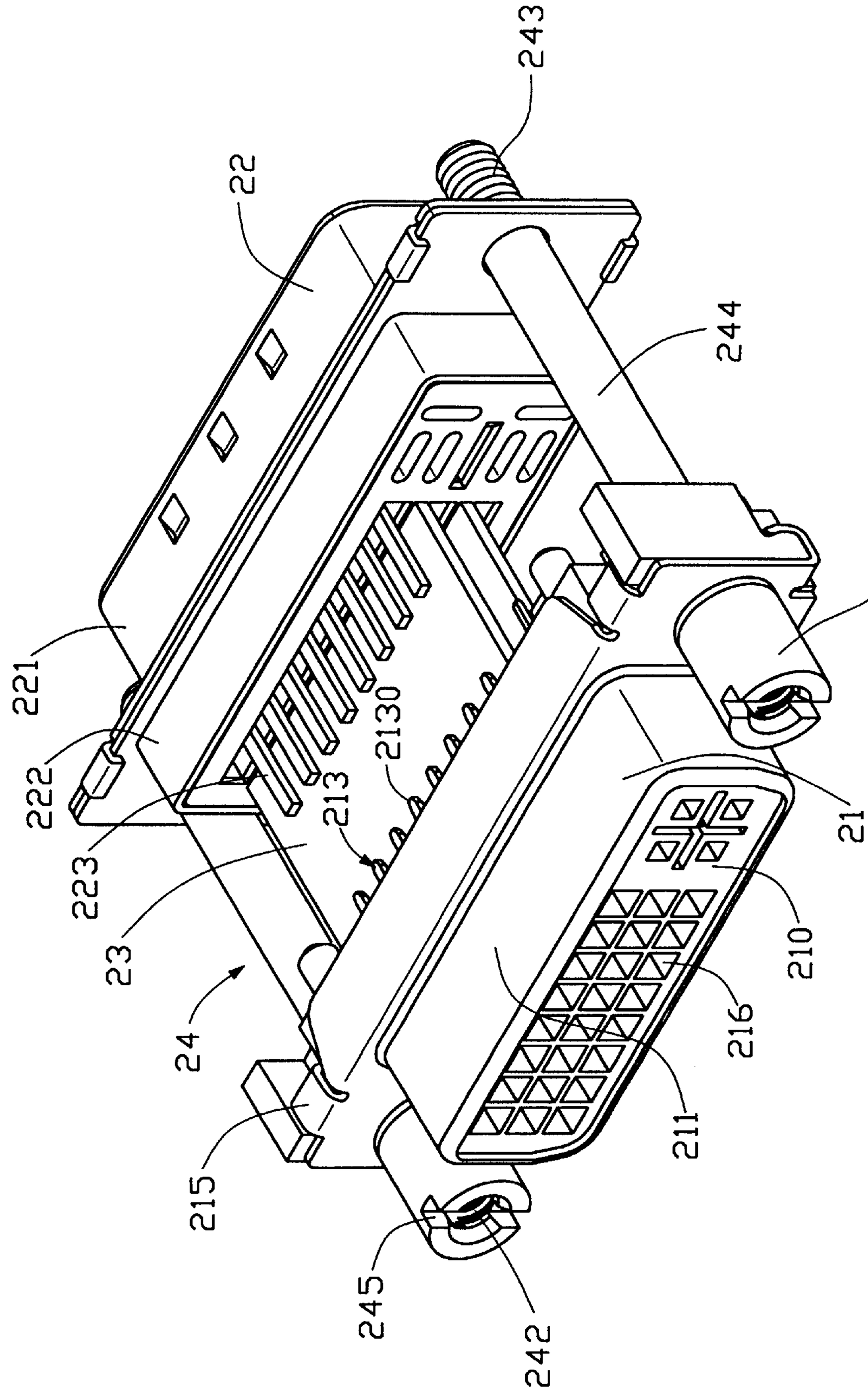

243
22
244
241
221
222
223
23
213
2130
21
24
210
216
211
215
245
242

FIG. 2

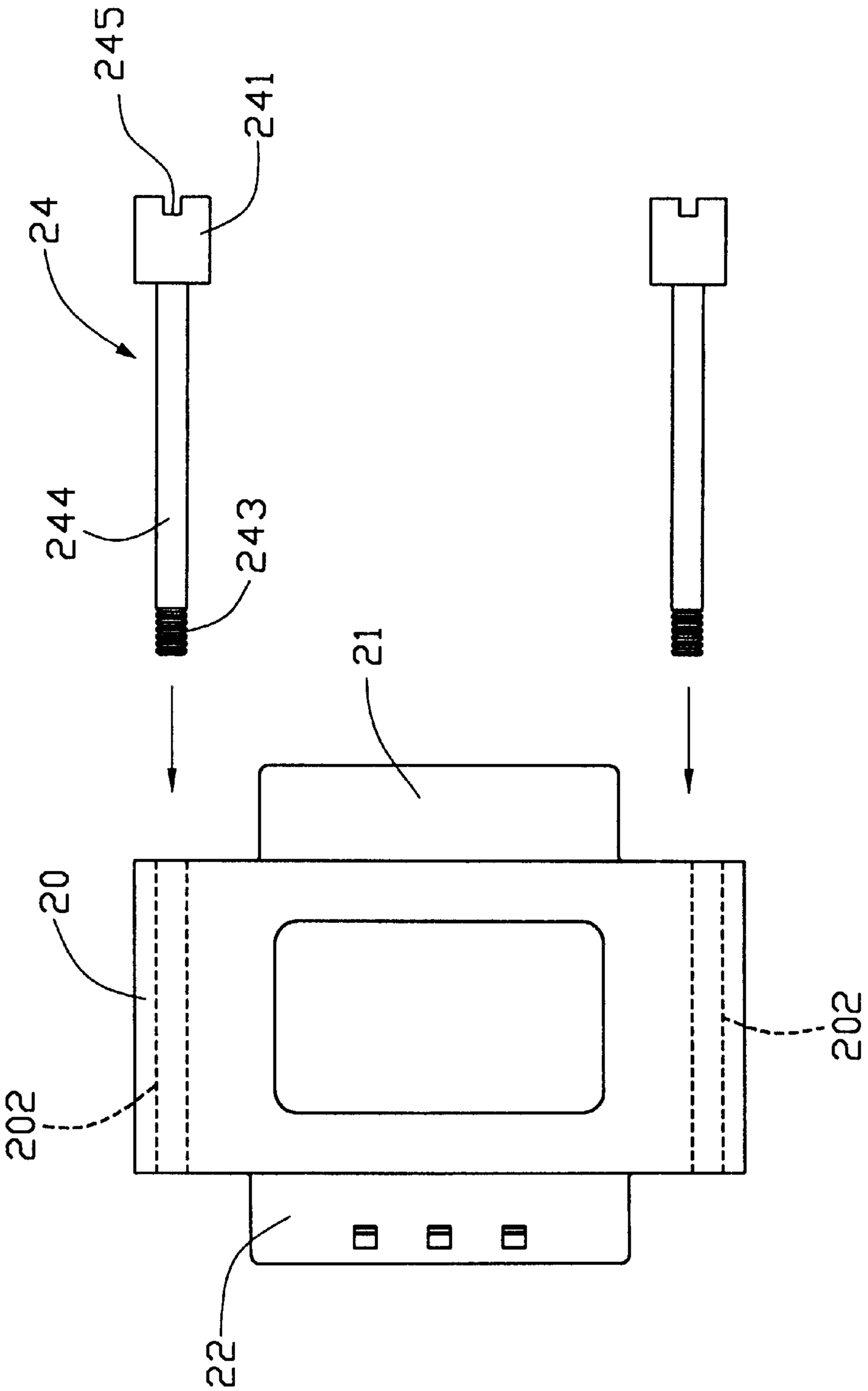


FIG. 3

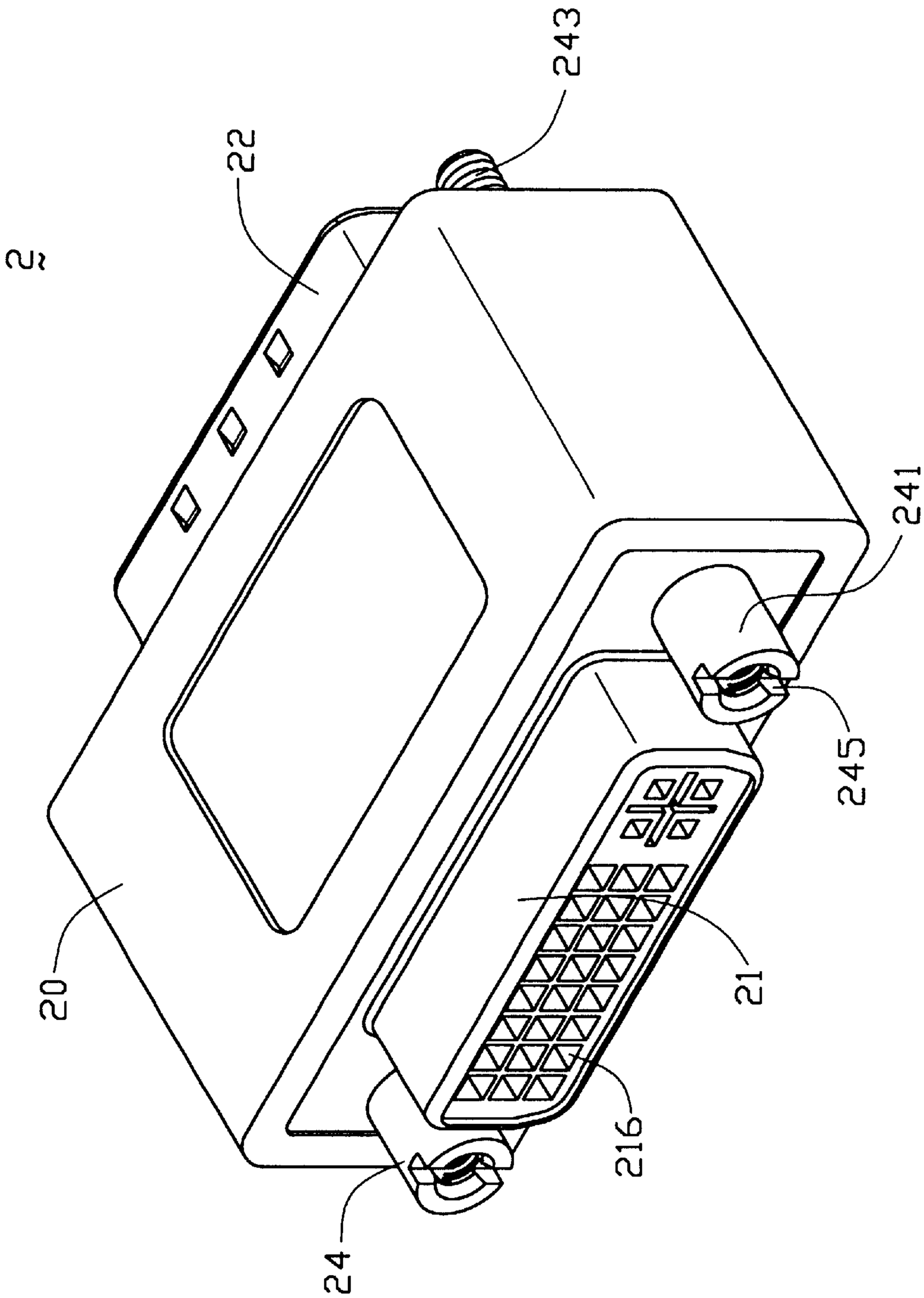


FIG. 4

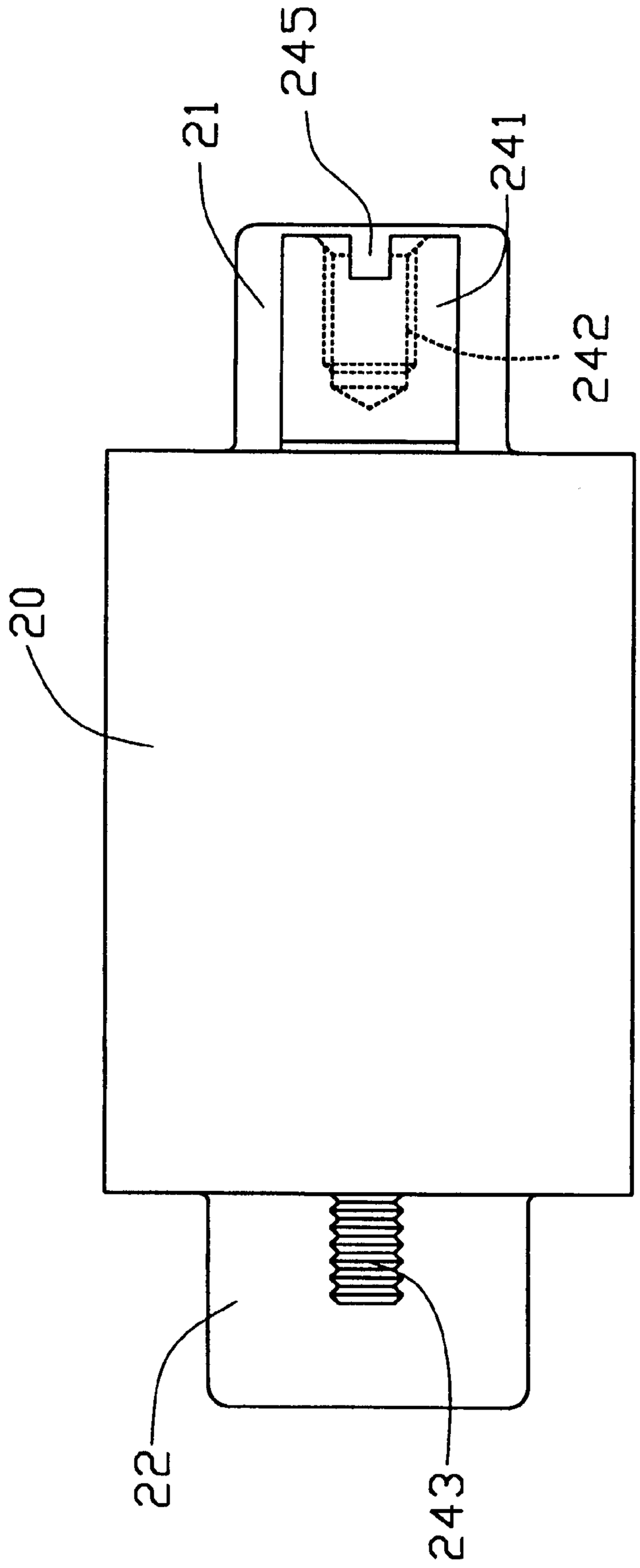


FIG. 5

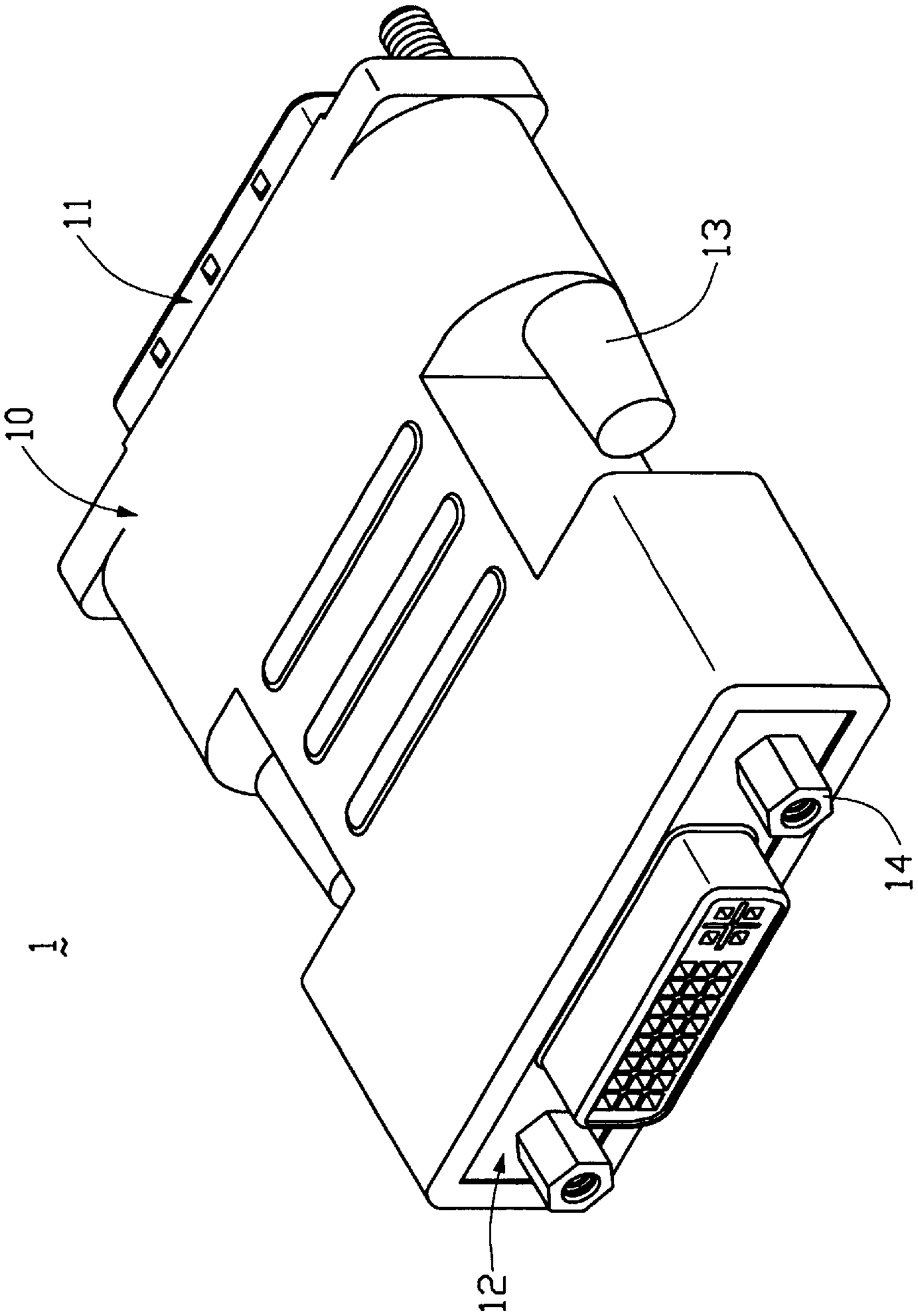


FIG. 6
(PRIOR ART)

ELECTRICAL ADAPTER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an electrical adapter, and particularly to a Digital Visual Interface (DVI) electrical adapter which can be used for electrically connecting together two different types of DVI electrical connectors.

2. Description of the Prior Art

The Digital Visual Interface (DVI) specification is a recently developed monitor interface specification for the PC industry. It provides specification for connectors used to connecting a monitor to a host computer. DVI technology has many advantages over conventional technology, such as video graphics array (VGA) technology. The DVI of specification covers both digital-only connector and combined digital & analog connector. An adapter is required to connect a monitor to a host computer when the monitor and the host computer have different DVI connectors.

Referring to FIG. **6**, a conventional DVI electrical adapter **1** includes an insulative housing **10**, a digital-only plug connector **11** and a combined digital & analog receptacle connector **12**. The digital-only plug connector **11** comprises a pair of screws **13** for fixing to nuts of a complementary receptacle connector mounted in a host computer (not shown), thereby ensuring a firm and reliably connection between the digital-only plug connector **11** and the complementary receptacle connector. The combined digital & analog receptacle connector **12** comprises a pair of nuts **14** for engaging with a pair of screws in a complementary plug connector of a cable assembly connecting to a monitor (not shown) for establishing firm and reliable connection therebetween.

However, since the screws **13** and the nuts **14** of the conventional DVI electrical adapter **1** are separate from each other, a pair of lateral recesses is required in the housing to accommodate heads of the pair of screws so that the screws can be rotated to threadedly engage the nuts of the complementary receptacle connector. This arrangement requires the conventional adapter to be long and bulky which is disadvantageous in view of the minimization trend in computer technology. Furthermore, the adapter **1** requires two separate screws **13** and two separate nuts **14**. This is disadvantageous from the standpoints of the increased cost of the components, increased inventory requirement and added assembly cost.

Hence, an improved DVI electrical adapter is desired to overcome the disadvantages of the prior art adapter.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a DVI electrical adapter which can be used for electrically connecting two different types of electrical connectors, the adapter having a compact configuration.

A DVI electrical adapter in accordance with the present invention comprises a digital-only plug connector, a combined digital & analog receptacle connector, a printed circuit boards (PCBs) joined between the plug connector and the receptacle connector, an insulative housing insert molded over a center of the DVI adapter and a pair of elongated fasteners. The digital-only plug connector can connect a second complementary receptacle connector in a host computer and the combined digital & analog receptacle connector can connect a first complementary plug connector to a monitor. The elongated fasteners are projecting through two sides of the insulative housing and include a first fixing end and a second fixing end. The second fixing end engages with nuts of a complementary receptacle connector mounted on the host computer. The first fixing end has a threaded recess accepting screws from a cable plug connector attached to the monitor. When the first fixing end moves, it can bring the second fixing end move synchronously so that fixes the elongated fasteners reliably when the second fixing end engages with nuts of a complementary receptacle connector mounted on the host computer.

Other objects, advantages and novel features of the invention will become more apparent from the following detailed description of the present embodiment when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded perspective view of a DVI electrical adapter in accordance with the present invention, wherein an insulative housing thereof is not shown;

FIG. **2** is an assembled perspective view of FIG. **1**;

FIG. **3** is a top view of the DVI electrical adapter of FIG. **1** with housing and showing fasteners to be mounted thereto;

FIG. **4** is an assembled perspective view of the DVI electrical adapter of the present invention;

FIG. **5** is a side elevational view of the DVI electrical adapter of FIG. **4**; and

FIG. **6** is a perspective view of a conventional DVI electrical adapter.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIGS. **1–3**, a DVI electrical adapter **2** in accordance with the present invention comprises a combined digital & analog receptacle connector **21** at a forward end of the adapter **2**, a digital-only plug connector **22** at a rearward end of the adapter **2**, two printed circuit boards (PCBs) **23** between the receptacle connector **21** and the plug connector **22**, an insulative housing **20** insert molded to the adapter **2** between the receptacle connector **21** and the plug connector **22**, and a single pair of elongated fasteners **24** projecting all the way through the adapter **2**. The combined digital & analog receptacle connector **21** is adapted to connect with a complementary plug connector for connecting to a monitor (not shown). The digital-only plug connector **22** is adapted to connect with a complementary receptacle connector mounted on a host computer (not shown). The insulative housing **20** (best shown in FIG. **3**) defines a through hole **202** through either side thereof.

The combined digital & analog receptacle connector **21** comprises an insulative housing **210**, a plurality of conductive contacts **213**, and a conductive shield **211**. The housing **210** defines a plurality of passageways **216** extending therethrough and receiving the contacts **213** therein. Each contact **213** defines a contact section (not shown) at one end thereof extending into the passageways **216** for electrically connecting with terminals of the complementary plug and an engaging section **2130** at an opposite end thereof extending out of the housing **210** for soldering to the PCBs **23**. The shield **211** covers a front, top, and bottom of the housing **210** and forms a pair of locking tabs **215** at each opposite end. The locking tabs **215** are bent to engage with corresponding lateral ends of the housing **210**, attaching the shield **211** to the housing **210**. The housing **210** and the shield **211** respectively define a pair of through holes **214** and a pair of circular openings **217** in opposite sides thereof. The open-

ings **217** align with the through holes **214**. Two rivets **212** respectively extend into the through holes **214** and the circular openings **217** and are fixed therein. Each rivet **212** defines a screw hole **2122** therein.

The digital-only plug connector **22** comprises an insulative housing **220**, a conductive rear shell **221** and a conductive front shell **222**. The housing **220** defines a plurality of plug passageways therethrough (not labeled). The contacts **223** are received in the plug passageways of the housing **220**. The contacts **223** have an engaging section **2230** at a forward oriented end thereof. The rear shell **221** forms two locking pieces **225** on two sides thereof for locking with the front shell **222**. Both the front hell **222** and the rear shell **221** define a pair of aligning through holes **224, 226** in opposite sides thereof.

Each PCB **23** has electrical components (not shown) and signal traces (not shown) thereon for processing electrical signals transmitted between the two different connectors **21, 22**. The engaging section **2130** of the contacts **213** and the engaging sections **2230** of the contacts **223** are respectively soldered onto corresponding PCBs **23** so that the combined digital & analog receptacle connector **21** is electrically connected with the digital-only plug connector **22**.

Referring also to FIG. **4** and FIG. **5**, the elongated fasteners **24** each have a first fixing end **241** and a second fixing end **243**. The first fixing end **241** is in the form of a nut which has a threaded recess **242** and a slot **245** in front of the threaded recess **242**. Each fastener **24** has an elongated post **244** extending rearwards from the first fixing end **241**. The elongated post **244** has external threads on a rearmost second fixing end **243**.

In assembly, after the receptacle connector and plug connector **21, 22** are soldered to the PCBs **23**, and the rivets **212** are fixed to the receptacle connector **21**, the subassembly of the plug connector **22**, the receptacle connector **21**, the PCBs **23**, and rivets **212** is put in a mold and the housing **20** is insert molded to the subassembly. The through holes **202** of the housing **20** are formed aligned with the through holes **214** and opening **217** of the receptacle connector **21**, the screw holes **2122** of the rivets **212**, and the through holes **224, 226** of the plug connector **22**. Finally, the elongated fasteners **24** are extended through the through holes **214** and openings **217** of the receptacle connector **21**, the screw holes **2122**, the through holes **202** of the housing **20**, and the through holes **224, 226** of the plug connector **22** to reach a position where the first fixing ends **241** abut a front of the receptacle connector **21** and the second fixing ends **243** extend beyond a rear of the plug connector **22**, as is best seen in FIG. **4**. The rivets **212** are used to prevent the fasteners **24** from falling out of the adapter **2**.

In use, the plug connector **22** is first connected to the complementary receptacle connector (not shown) of the host computer (not shown) and the adapter **2** is secured to the host computer by rotating the first fixing ends **241** of the fasteners **24** until the second fixing ends **243** are firmly engaged with nuts of the complementary receptacle. The slots **245** are devised so that a tool such as a flat screwdriver can be used to tighten the engagement between the second fixing ends **243** and the corresponding nuts. Then, the complementary plug connector of the cable connector assembly of the monitor is connected to the receptacle connector **21**, and the screws on said complementary plug connector are threadedly engaged with the threaded recesses **242** of the first fixing ends **241**, whereby the plug of the cable connector assembly is secured to the adapter **2**. Accordingly, the host computer and the monitor, which have different video interfaces, are electrically connected together.

It is to be understood, however, that even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosure is illustrative only, and changes may be made in detail, especially in matters of shape, size, and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

What is claimed is:

1. An electrical adapter, comprising:

a first electrical connector;

a second electrical connector different from the first electrical connector;

an insulative housing connecting both the first electrical connector and the second electrical connector at opposite ends of the housing; and

at least an elongated fastener extending through the first connector, the housing and then the second connector, the elongated fastener having a first fixing end and a second fixing end adapted for respectively engaging with fixing elements of a first complementary connector engaging with the first connector and a second complementary connector engaging the second connector, respectively;

wherein the first electrical connector comprises a first housing having a plurality of terminal receiving passageways, a plurality of first contacts received in the terminal receiving passageways and a shield forming two locking tabs on each of two longitudinal sides thereof and which locking tabs lock the shield to the first housing, thereby fixing the shield to the first housing, a rivet with a screw hole axially defined therethrough is fixedly received in the first housing, and the fastener extend through the screw hole;

wherein the second electrical connector comprises a second housing having a plurality of the second contacts received therein, the second housing of the second electrical connector having front and rear shells, the rear shell forming two locking tabs on each of two longitudinal sides thereof which locking tabs lock with the front shell, the two shells of the second electrical connector respectively define at least a through hole in a side thereof through which the elongated fastener extends; and

wherein the adapter further comprises a printed circuit board electrically and mechanically connected between the first and the second electrical connectors, the terminals of the two electrical connectors being soldered to the printed circuit board.

2. The electrical adapter as claimed in claim **1**, wherein the electrical adapter is a Digital Visual Interface (DVI) electrical adapter.

3. The electrical adapter as claimed in claim **1**, wherein the first fixing end of the elongated fastener is in the form of a nut.

4. The electrical adapter as claimed in claim **3**, wherein the second fixing end of the elongated fasteners has an external thread.

5. The electrical adapter as claimed in claim **4**, wherein the first fixing end and the second fixing end of the elongated fastener are both located outside of the insulative housing.

* * * * *